Check List the journal of biodiversity data

LISTS OF SPECIES

Check List 11(3): 1630, April 2015 doi: http://dx.doi.org/10.15560/11.3.1630
ISSN 1809-127X © 2015 Check List and Authors

Non-volant mammals from Baturité Ridge, Ceará state, Northeast Brazil

Hugo Fernandes-Ferreira[1*], **Newton Mota Gurgel-Filho**[1], **Anderson Feijó**[1], **Sanjay Veiga Mendonça**[2], **Rômulo Romeu da Nóbrega Alves**[3] and **Alfredo Langguth**[1]

1 Universidade Federal da Paraíba, Departamento de Sistemática e Ecologia, Laboratório de Mastozoologia, João Pessoa, Paraíba State, Brazil, CEP 58051-900
2 Universidade Estadual do Ceará, Departamento de Avicultura, Laboratório de Estudos Ornitológicos, Fortaleza, Ceará State, Brazil, CEP 60714-903
3 Universidade Estadual da Paraíba, Departamento de Biologia, Campina Grande, Paraíba State, Brazil, CEP 58429-500
* Corresponding author. E-mail: fernandes-ferreira@ufpb.br

Abstract: Baturité Ridge is an important Atlantic Forest remnant inserted in the Caatinga Morphoclimatic Domain located in the Ceará state, Northeast Brazil. Although this area presents high rates of endemism and has been investigated by many researchers in the past, there was never an investigation regarding local mammals. In this context, this study aims to survey the non-volant mammals of this region to serve as a basis for future ecological and conservation studies. The work was conducted between 2009 and 2014, based on analyses of voucher specimens from zoological collections, capture of specimens in fieldwork, visual and photographic records, and interviews with selected local residents. Altogether, 32 species were documented and seven are present on lists of endangered animals. In addition, interviews indicated that three non-recorded species probably occur in the area and another two were pointed out by local people as locally extinct. Discussions about identification and conservation aspects were presented.

Key words: Atlantic Forest, *brejos de altitude*, Caatinga, mammalian, survey

INTRODUCTION

According to Prance (1982), Northeast Brazil is a center of plant endemism, consisting of deciduous forests, semi-deciduous dry forests, montane and submontane ombrophilous forests, and open and arboreal dry vegetation, with several areas of refuge for fauna and flora. The most important of these refuge areas are the *brejos de altitude* (altitudinal cloud forests) made up of residual ridges with vegetation that resisted drastic climatic changes during the Pleistocene (Ab'Saber 1992). These forest areas are surrounded by the Caatinga, a semi-arid biome endemic to Brazil, but have flora and fauna typically related to both the Amazonian and Atlantic Forests, as well as ancient areas that connected these two biomes, as presented by several studies (Vanzolini et al. 1980; Andrade–Lima 1982; Mares et al. 1985; Figueiredo and Barboza 1990; Borges–Nojosa and Caramaschi 2003; Sousa 2004; Borges–Nojosa 2007).

The Brazilian state of Ceará is covered by cloud forests in areas of high altitude, such as in the Ibiapaba, Araripe, Maranguape, Aratanha and Baturité ridges, the last one being where this research was developed. Baturité is the region richest in species and has a great importance in maintaining biodiversity and water resources for the state (Mantovani 2007). For example, this area is where Hoogmoed et al. (1994) described the frog *Adelophryne baturitensis*; Rodrigues and Borges (1997) revealed the lizard *Leposoma baturitensis*; Tribe (2005) proposed a new subspecies of rodent (*Rhipidomys cariri baturiteensis*); Passos et al. (2007) described the snake *Atractus ronnie*; Feijó and Langguth (2013) discovered *Coendou baturitensis*, a new species of porcupine, and Roberto et al. (2014) revealed a new species of Bufonidae (*Rhinella casconi*). Additionally, this is one of the most important bird conservation sites in Northeast Brazil, due to the presence of 12 endangered species, including *Pyrrhura grisepectus* (Gray-breasted Parakeet), the most endangered parakeet of the Americas (Olmos et al. 2005; Girão 2007). Due to these factors, Oliveira et al. (2003) considered this region to have high conservation priority.

The study of mammals in Ceará, despite being approached by several authors, still faces major gaps in knowledge. Fernandes-Ferreira et al. (2014), in reviewing the history of vertebrate zoology research of this state, showed that there are few studies involving

mammals, and none whatsoever in the central region of the state.

Following the studies of Rocha (1908, 1945, 1948) and Paiva (1973), surveys of mammals involving the whole of Ceará's territory have only been published recently. Gurgel-Filho and Langguth (in press) describe and discuss the morphology of species of Didelphimorphia (Didelphidae), Rodentia (Sigmodontinae) and Chiroptera collected in Ceará and housed in the main Brazilian zoological collections. Feijó and Langguth (2013) conducted a taxonomic revision of medium and large sized species based on morphological characters, also including in their research the neighboring states of Paraíba and Pernambuco.

Despite the importance of Baturité for biogeography, ecology and conservation, information about its mammalian fauna has never been appraised and is available only through the *Serviço Nacional da Peste* (National Service of the Bubonic Plague) fieldwork between 1930 and 1950. The purpose of this government program was to catch small mammals in order to investigate and eradicate tropical diseases (Freitas 1957; Oliveira and Franco 2005). Thus, the aim of this paper is to present an updated and comprehensive survey on non-volant mammals of Baturité and discuss aspects of their conservation.

MATERIALS AND METHODS

Study site

Baturité (04°07′48″ S, 038°03′19″ W) is the largest ridge of the Ceará state, encompassing the municipalities of Aratuba, Baturité, Capistrano, Caridade, Guaramiranga, Mulungu, Pacoti and Redenção. This region presents an average altitude of 600 m and a maximum of 1,114 m. The combination of altitude with the course of the relief in relation to the sea results in average temperatures between 23°C at higher altitudes areas to 27°C in the lower sites. Its geographical position promotes orographic rainfall on the windward side, due to coastal winds with high humidity, generating high rainfall rates (900–1,400 mm/year) and corresponding humidity (700 mm/year). These characteristics established tropical submontane and montane rainforests. On the leeward side, lower relative humidity rates promote a large influence of deciduous dry vegetation typical of the Caatinga biome. This area is also included in the Baturité Environmental Protection Area (Mantovani 2007).

Data collection

This survey was conducted between 2009 and 2014 using four sources of information: 1) the analysis of voucher specimens from zoological collections and

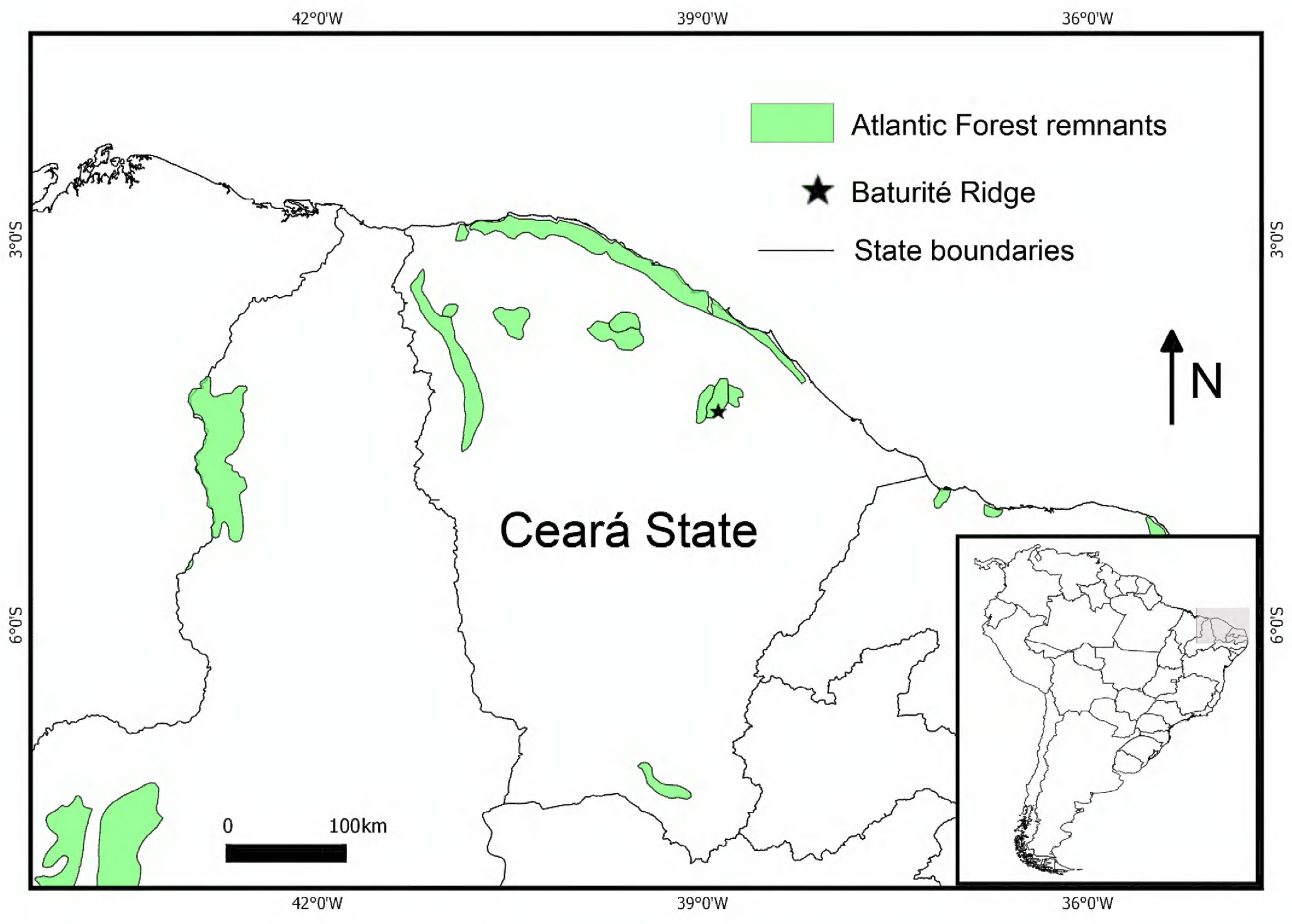

Figure 1. Location of Baturité Ridge, Ceará state, Northeast Brazil.

museums; 2) the capture of specimens in the field; 3) visual and photographic records, and 4) interviews with selected local residents.

Mammal collections of the following Brazilian institutions were visited: Universidade Federal do Ceará, Fortaleza, Ceará (UFC); Universidade Federal da Paraíba, João Pessoa, Paraíba (UFPB); Museu de Zoologia da Universidade de São Paulo, São Paulo (MZUSP); Museu Nacional de História Natural do Rio de Janeiro, Rio de Janeiro (MNRJ); Universidade Federal de Pernambuco, Recife, Pernambuco (UFPE) and Museu Paraense Emílio Goeldi, Belém, Pará (MPEG). All specimens were examined and their identifications checked and updated according to current taxonomic literature (Gardner 2008; Paglia et al. 2012; Feijó and Langguth 2013).

Field samples were obtained through two stations of pitfall traps (adapted from Aurichio and Salomão 2002), one built in the windward and another on the leeward side of the mountain. Each trap consisted of four buried 30 L buckets and three plies each measuring 10 m long and 60 cm wide. Thirty Sherman traps (25 × 8 × 8 cm) were also installed to capture small mammals in the same areas. These actions were performed sporadically, during both dry and wet seasonal periods, and were authorized by the Brazilian federal authorities (SISBIO / ICMBio license number 19801-02). The animals were handled according to the protocols described by Sikes et al. (2011). All captured animals were deposited in the mammal collection of the Universidade Federal da Paraíba. This methodology was completed with visual and photographic records performed in the forest trails.

Local residents with any manner of interaction with wild mammals were interviewed, and the "snowball" technique (Bailey 1994) was applied to select people based on the first group. In this way a total of 110 "local specialists" (people who consider themselves, and are likewise recognized within the community itself, to be knowledgeable on the subject) were identified and interviewed (Hays 1976). Visual and photographic records were made in homes of interviewees (in the case of wild pets), many of which also offered to donate biological samples (e.g., skin, feet, antlers, skeleton, and claws) of game. This practice was approved by the Ethics Committee of the University Hospital of Federal University of Paraíba (Protocol 418/09).

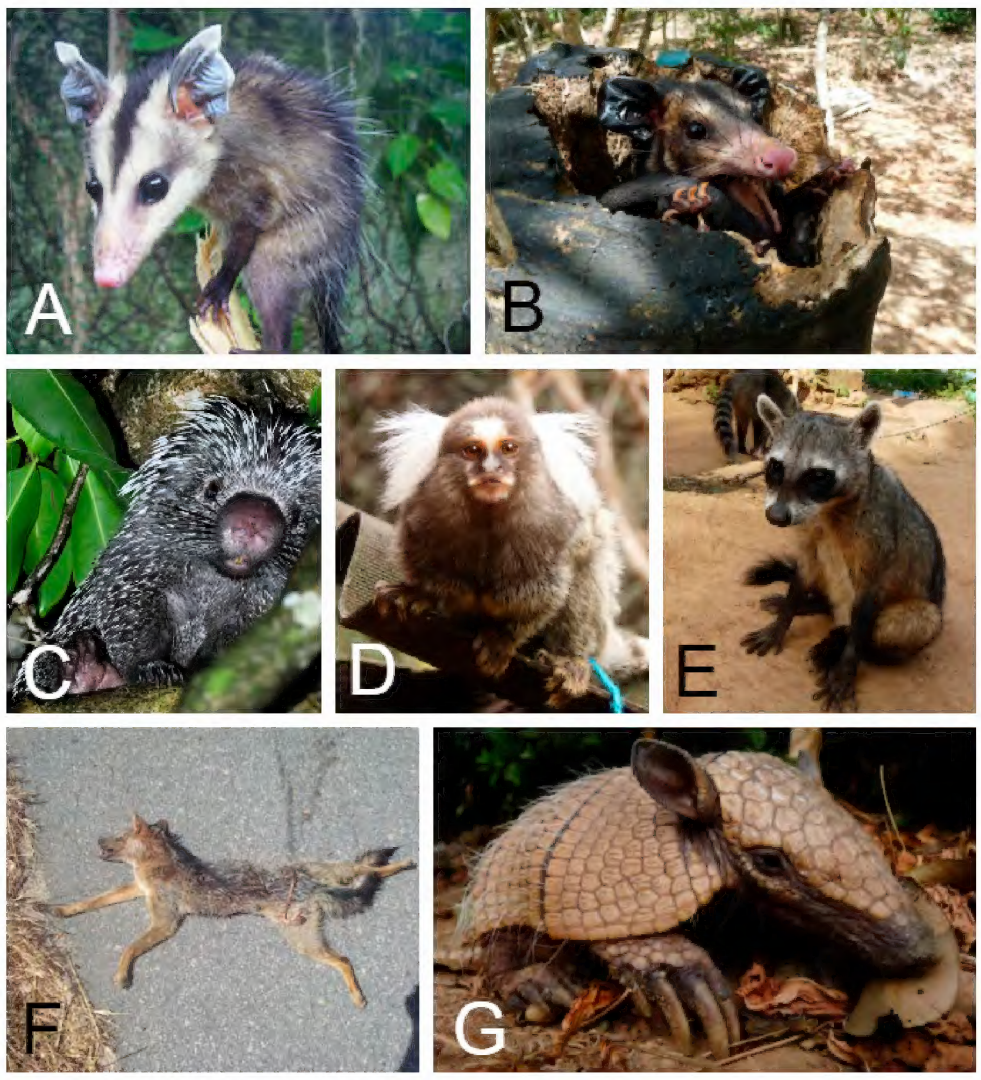

Figure 2. Mammals photographed in Baturité Ridge, Ceará state, Northeast Brazil. **A**: *Didelphis albiventris*. **B**: *Didelphis* gr. *marsupialis*. **C**: *Coendou baturitensis*. **D**: *Callithrix jacchus* (kept as pet by local community). **E**: *Procyon cancrivorus* (kept as pet by local community). **F**: *Cerdocyon thous* (road-kill). **G**: *Euphractus sexcinctus*. Photos by SVM (A) and HF-F (B, C, D, E and F).

RESULTS

Altogether, 32 species of non-volant mammals belonging to 12 families and seven orders with confirmed records were documented in Baturité (Table 1, Figure 2, Appendix 1).

In addition, interviews revealed that three non-recorded species probably occur in the area (*Nasua nasua, Sapajus libidinosus* and *Eira barbara*) and another two were pointed out by local people as locally extinct (*Panthera onca* and *Cuniculus paca*). The presence of *Nasua nasua* was mentioned by eleven informants. This species occurs in Ceará but the only location with a voucher specimen is the Ibiapaba Ridge, in the northwestern region of the state (Feijó and Langguth 2013). Twenty-nine informants cited the presence of *Eira barbara* in the study area. According to these interviews, this mustelid is probably rare in Baturité and inhabits areas above 700 m high. After several people stated the extinction of *Sapajus libidinosus*, seven informants reported the discovery of a population in rocky areas of the study site. According to thirty-seven respondents, *Panthera onca* occurred in wetlands of Baturité until about 25 years ago. Ten others claim that its occurrence is still likely. Twelve local hunters affirmed the local extinction of *Cuniculus paca* for about 40 years, caused primarily by excessive hunting.

DISCUSSION

Most of the non-volant mammalian species recorded in Ceará can be found in Baturité. Of the 21 species of small terrestrial mammals surveyed in this state (Gurgel-Filho and Langguth, in press), 15 (71.4%) were recorded in Baturité. Among the medium and large sized species (Feijó and Langguth 2013) this proportion reaches 61.5%.

A detailed description of the species documented here can be found in the studies of Gurgel-Filho and

Langguth (in press) and Feijó and Langguth (2013), however, some animals deserve some discussion on their their taxonomy. The record of a black-eared *Didelphis* (Figure 2b) has a problem with its identification, as the differences between the two possible species, *Didelphis marsupialis* and *Didelphis aurita*, are just morphometric (Cerqueira and Lemos 2000). Baturité is located in a gap of the known distribution of this group which shares the characteristics of black ears (Cerqueira and Tribe 2008). Thus, we prefer to considerate it *Didelphis* gr. *marsupialis* and suggest efforts in genetic and morphological studies to resolve this problem. The taxonomy of the genus *Oligoryzomys* is poorly done, because there are many variations of cranial morphometry (see Weksler and Bonvicino 2005). Thus, new evidences are required for a safe identification of the species found in the study area.

Among the species identified and cited here, seven are present on lists of endangered animals (MMA 2014, IUCN 2015). Six of these species, along with another seven, are also documented on lists of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES 2015) (Table 2).

It is also important to note that there are no other known occurrence areas of *Coendou baturitensis* (Figure 2c) beyond Baturité, although some non-published visual and photographic evidence suggest the presence of this species in other rainforests, such as the Ibiapaba and Maranguape ridges.

Furthermore, the presence of *Speothos venaticus* suggests a critically endangered local population of this canid. Its recent discovery represents the first record of this species in a location within the Caatinga's Morphoclimatic Domain, done so by means of a female cub carcass that was donated by local residents (Fernandes-Ferreira et al. 2011). Jorge et al. (2013), in a review of the conservation status of this species in Brazil, pointed out the possibility of a misidentification by the researchers who reported the bush dog in Ceará and, therefore, they did not consider the discovery as an accurate distribution extension. Such suspicion was justified by a supposed history of confusion in the identification of species of wild canids in that region. The authors used as

Table 1. Non-volant mammals recorded in Baturité Ridge.

Order/Family	Species	Record*
Didelphimorphia		
Didelphidae		
	Marmosa murina (Linnaeus, 1758)	VS
	Micoureus demerarae (Thomas, 1905)	VS
	Monodelphis domestica (Wagner, 1842)	VS, IN
	Monodelphis americana (Müller, 1776)	VS
	Didelphis albiventris Lund, 1840	VS, PR, VR, IN
	Didelphis gr. *marsupialis* Linnaeus, 1758	VS, PR, IN
Cingulata		
Dasypodidae		
	Dasypus novemcinctus Linnaeus, 1758	VS, IN
	Euphractus sexcinctus (Linnaeus, 1758)	VS, PR, IN
Pilosa		
Myrmecophagidae		
	Tamandua tetradactyla (Linnaeus, 1758)	VS, IN
Primates		
Cebidae		
	Callithrix jacchus (Linnaeus, 1758)	VS, PR, IN
Carnivora		
Felidae		
	Leopardus pardalis (Linnaeus, 1758)	VS, IN
	Leopardus tigrinus (Schreber, 1775)	VS, IN
	Leopardus wiedii (Schinz, 1821)	VS, IN
	Puma concolor (Linnaeus, 1771).	VS, IN
	Puma yagouaroundi (É. Geoffroy, 1803)	VS, IN
Canidae		
	Cerdocyon thous (Linnaeus, 1766)	VR, PR, IN
	Speothos venaticus (Lund, 1842)	VS, IN
Procyonidae		
	Procyon cancrivorus (G. Cuvier, 1798)	VS, PR, IN
	Galictis cuja (Molina, 1782)	VR
Mephitidae		
	Conepatus amazonicus (Lichtenstein, 1838)	VR, IN
Artiodactyla		
Cervidae		
	Mazama gouazoubira (Fischer, 1814)	VS, IN
Rodentia		
Erethizontidae		
	Coendou baturitensis Feijó & Langguth, 2013.	VS, PR, IN
Dasyproctidae		
	Dasyprocta sp.	VR, IN
Caviidae		
	Galea spixii (Wagler, 1831)	VS, IN
	Kerodon rupestris (Wied, 1820)	VR, IN
Echymidae		
	Thricomys laurentius Thomas, 1904	VR, IN
Cricetidae	*Rhipidomys cariri* Tribe, 2005	VS
	Oligoryzomys cf. *nigripes* (Olfers, 1818)	VS
	Necromys lasiurus (Lund, 1841)	VS
	Cerradomys langguthi Percequillo, Hingst-Zaher & Bonvicino, 2008	VS
	Euryoryzomys aff. *russatus* (Wagner, 1848)	VS
	Holochilus sciureus (Wagner, 1842)	VS

* VS (voucher specimens); IN (interview); PR (photographic record); VR (visual record).

Table 2. Endangered mammals from Baturité Ridge and its respective category of threat according to Brazilian Ministry of Environment (MMA 2014), IUCN (2015) and CITES (2015).

Species	MMA*	IUCN*	CITES
Speothos venaticus	VU	NT	Appendix I
Cerdocyon thous	-	-	Appendix II
Leopardus wiedii	VU	NT	Appendix I
Leopardus tigrinus	EN	VU	Appendix I
Puma concolor	VU	LC	Appendix II
Panthera onca	VU	NT	Appendix I
Puma yagouaroundi	VU	-	Appendix II
Eira barbara	-	-	Appendix III
Galictis cuja	-	-	Appendix III
Cuniculus paca	-	-	Appendix III
Kerodon rupestris	VU	-	-
Callithrix jacchus	-	-	Appendix II
Sapajus libidinosus	-	-	Appendix II

* VU (vulnerable); NT (near threatened); LC (least concern).

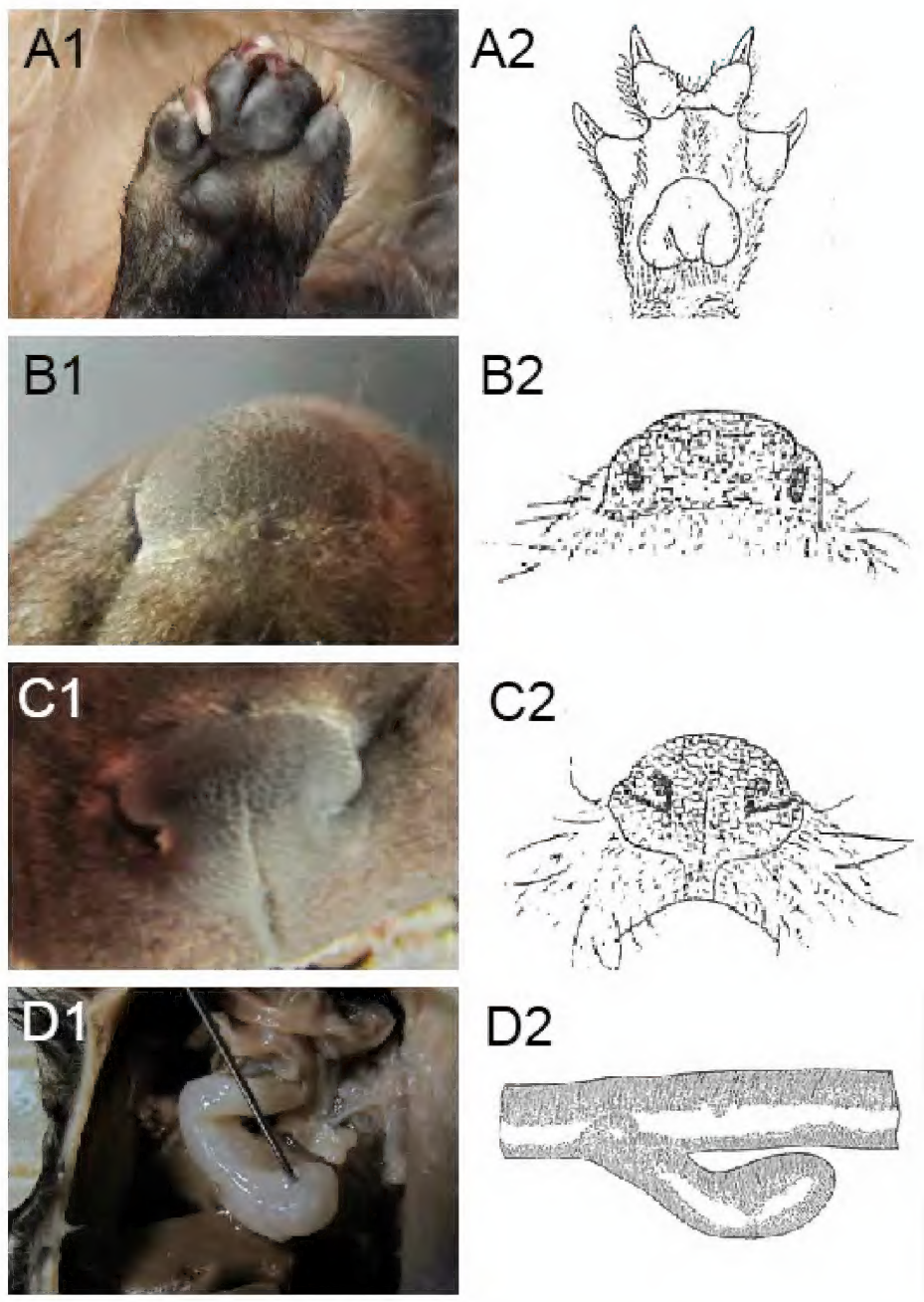

Figure 3. Morphological comparison between the specimen of *Speothos venaticus* recorded by Fernandes-Ferreira et al. (2011) in Baturité Ridge (A1 to D1) and some unique characteristics for this species illustrated in Langguth (1969) (A2 to D2). **A**: Left foot, showing the digital pads of the third and fourth digits united at their inner proximal angles, giving the appearance of fusion of the two pads. **B**. Shape of rhinarium (superficial vision). **C**: Shape of rhinarium (frontal vision). **D**: Simple intestinal caecum. Photos by HF-F.

reference for this statement an article on misidentifications of canid species that transmit zoonosis which was based on documents related to epidemiology and human health (Courtenay et al. 1996). Therefore, this purely medical paper has no connection to typical zoological work, which examines external and internal morphology by specialized taxonomists in order to ascertain the identity of a specimen. Because Jorge et al. (2013) did not analyze the voucher specimen and did not discuss the zoological information provided by Fernandes-Ferreira et al. (2011), which was based on a vouchered specimen unambiguously identified as *Speothos venaticus*, we consider that the disagreement on the distribution extension has no scientific support. Nevertheless, Figure 3 presents a morphological comparison between the specimen recorded by Fernandes-Ferreira et al. (2011) (UFPB 6272) and unique characteristics for this species illustrated in Langguth (1969) in order to clear up this controversy. Other exclusive biological patterns of *S. venaticus* such as the protruding forehead and the eight symmetrical palatal rugae can be verified by analyzing the voucher specimen.

The presence of these endangered species deserves the attention of researchers and authorities, especially when considering the various factors of environmental impact on Baturité, such as deforestation, overexploitation of natural resources, habitat fragmentation, the introduction of invasive species, pollution of water resources, road kills (Figure 2f), and real estate speculation, as pointed by Oliveira et al. (2007).

It is necessary to emphasize that hunting activities were cited in interviews and are related to 22 (68.7%) species, beyond the six species with no confirmed occurrence in Baturité. If considering only medium and large sized mammals, the proportion of game species in relation to the total richness is 100%. In the municipality of Caridade, for example, local residents (n = 12) reported the killing of three individuals of *Puma concolor* between 2009 and 2010. This species and other carnivores are hunted locally for the purpose of population control, because of its potential attack on domestic animals like calves, pigs, goats and poultry. However, most mammals are used for food purposes. Some species are also kept by local inhabitants as pets, in the case of *Callithrix jacchus* (Figure 2d), *Procyon cancrivorus* (Figure 2e), *Mazama gouazoubira*, *Puma yagouaroundi* and *Tamandua tetradactyla*, or even for medicinal practices. The hunting of birds, reptiles and amphibians in Baturité has already been investigated by other studies which indicate large impacts on the local fauna (Fernandes-Ferreira et al. 2012, 2013). This is a reality observed in several locations in Brazil, where hunting and consumption of wild animals persist in all regions of the country, with complete disregard of legal implications (Cullen-Jr. et al. 2001; Peres and Nascimento 2006; Fernandes-Ferreira and Alves 2014). Moreover, the absence of ecological studies focusing on wild mammals in the study area surely does not reveal local threats or population depletion of all species.

ACKNOWLEDGEMENTS

We thank the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) and the Conselho de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) for funding the research of the authors; Dr. Diva Maria Borges-Nojosa for scientific support; Roberto Otoch, for historical information about the local fauna; Cleiton and Gleidison Lima for assistance in fieldwork and the Kenney Blumer and Veiga families for hosting us in the study area.

LITERATURE CITED

Ab'Saber, A.N. 1992. A teoria dos refúgios. Estudos Avançados 15(1): 9–11.

Andrade-Lima, D. 1982. Present-day forest refuges in Northeastern Brazil; pp. 245–251, in: G.T. Prance (ed.). Biological diversification in the tropics. New York: Columbia University Press.

Bailey, K. 1994. Methods of social reached. 4th edition. New York: The Free Press.

Borges-Nojosa, D.M. 2007. Diversidade de anfíbios e répteis da Serra de Baturité, Ceará; pp. 225–247, in: T.S. Oliveira and F.S. Araújo (eds.). Biodiversidade e conservação da biota na serra de Baturité, Ceará. Fortaleza: Edições UFC, Coelce.

Borges-Nojosa, D.M. and U. Caramaschi. 2003. Composição e análise comparativa da diversidade e das afinidades biogeográficas dos lagartos e anfisbenídeos (Squamata) dos brejos-nordestinos; pp. 489-540, in: I.R. Leal, M. Tabarelli and J.M.C. Silva (eds.). Ecologia e conservação da caatinga. Recife: Editora Universitária da UFPE.

Cerqueira, R. and B. Lemos. 2000. Morphometric differentiation between Neotropical black-eared opossums, *D. marsupialis* and *D. aurita* (Didelphimorphia, Didelphidae). Mammalia 64(1): 319–327. doi: 10.1515/mamm.2000.64.3.319

Cerqueira, R. and C.J. Tribe. 2008. Genus *Didelphis* Linnaeus, 1758; pp.17–25, in: Gardner, A.L. (ed.). Mammals of South America. Chicago: University of Chicago Press.

CITES. 2014. Convention on International Trade in Endangered Species of Wild Fauna and Flora. Appendices I, II and III. Accessed at http://www.cites.org/eng/app/appendices.php, 10 February 2015.

Courtenay, O., E.W. Santana, P.J. Johnson, I.A.B. Vasconcelos and A.W. Vasconcelos. 1996. Visceral leishmaniasis in the hoary zorro *Dusicyon vetulus*: a case of mistaken identity. Transactions of the Royal Society of Tropical Medicine and Hygiene 90(5): 498–502. doi: 10.1016/S0035-9203(96)90293-X

Cullen-Jr. L., E.R. Bodmer and C. Valladares-Padua. 2001. Ecological consequences of hunting in Atlantic forest patches, São Paulo, Brazil. Oryx 35(2): 137–144. doi: 10.1046/j.1365-3008.2001.00163.x

Feijó, J.A. and A. Langguth. 2013. Mamíferos de médio e grande porte do Nordeste do Brasil: distribuição e taxonomia, com descrição de novas espécies. Revista Nordestina de Biologia 22(1): 3–225.

Fernandes-Ferreira, H. and R.R.N Alves. 2014. Legislação e mídia envolvendo a caça de animais silvestres no Brasil, uma perspectiva histórica e socioambiental. Gaia Scientia 8(1): 1–7.

Fernandes-Ferreira, H., H. Nascimento, D.C. Lima, N.M. Gurgel-Filho and R.R.N. Alves. 2014. História da Zoologia no Estado do Ceará Parte I: Vertebrados Continentais. Gaia Scientia 8(1): 99–120.

Fernandes-Ferreira, H., J.A. Feijó, N.M. Gurgel- Filho, S.J. Mendonça, R.R.N. Alves and A. Langguth, A. 2011. An unexpected record of *Speothos venaticus* (Carnivora, Canidae) in the Caatinga Domain. Revista Nordestina de Biologia 20(2): 59–65.

Fernandes-Ferreira, H., S.V. Mendonça, C. Albano, F.S. Ferreira and R.R.N. Alves. 2012. Hunting, use and conservation of birds in Northeast Brazil. Biodiversity and Conservation 21(1): 221–244. doi: 10.1007/s10531-011-0179-9

Fernandes-Ferreira, H., S.V. Mendonca, R.L. Cruz, D.M. Borges-Nojosa and R.N.N. Alves. 2013. Hunting of herpetofauna in montane, coastal, and dryland areas of Northeastern Brazil. Herpetological Conservation and Biology 8(3): 652–666.

Figueiredo, M.A. and M.A. Barboza. 1990. A vegetação e a flora na Serra de Baturité – Ceará. Coleção Mossoroense, série B (747): 1–10.

Freitas, C.D. 1957. Notícia sobre a peste no Nordeste. Revista Brasileira de Malariologia e Doenças Tropicais 9: 123–33.

Gardner, A.L. 2008. Mammals of South America, volume 1: marsupials, xenarthrans, shrews, and bats. Chicago: University of Chicago Press.

Gurgel-Filho, N.M. and A. Langguth. [In press]. Pequenos mamíferos do Ceará (Marsupiais, Morcegos e Roedores Sigmodontíneos). Revista Nordestina de Biologia.

Hays, T.E. 1976. An empirical method for the identification of covert categories in ethnobiology. American Ethnologist 3(3): 507. doi: 10.1525/ae.1976.3.3.02a00070

Hoogmoed, M. S., D.M. Borges and P. Cascon. 1994. Three new species of the genus *Adelophryne* (Amphibia: Anura: Leptodactylidae) from northeastern Brazil, with remarks on the other species of the genus. Zoologische Mededelingen 68(24): 271–300.

IUCN. 2015. IUCN Red List of threatened animals. International Union for Conservation of Nature. Accessed at http://www.iucnredlist.org, 10 February 2015.

Jorge, R.P.S., B.M. Beisiegel, E. Lima, M.L.S.P. Jorge, M.R.P. Leite-Pitman and R.C. Paula. 2013. Avaliação do risco de extinção do cachorro-vinagre *Speothos venaticus* (Lund, 1842) no Brasil. Biodiversidade Brasileira 3(1): 179–190.

Langguth, A. 1969. Die Sudamerikanischem Canidae Unter Besonderer Berucksichtigung Des Manhnenwolfes *Chrysocyon Brachyurus* Ill. Zeitschrift für Wissenschaftliche Zoologie 179(1/2): 1–188.

Mantovani, W. 2007. Conservação de Biodiversidade; p. 3-16, in: T.S. Oliveira and F.S. Araújo (ed.). Biodiversidade e conservação da biota na serra de Baturité, Ceará. Fortaleza: Edições UFC, Coelce.

Mares, M.A., M.R. Willig and T.E. Lancher. 1985. The Brazilian caatinga in South America zoogeography: tropical mammals in a dry region. Journal of Biogeography 12(1): 57–69. doi: 10.2307/2845029

Marques, J.G. 2002. O olhar (des)multiplicado. O papel do interdisciplinar e do qualitativo na pesquisa etnobiológica e etnoecológica; pp. 31–46, in: Amorozo, M.C.M., L.C. Mingg and S.M.P. Silva (eds.). Métodos de coleta e análise de dados em etnobiologia, etnoecologia e disciplinas correlatas. Rio Claro: UNESP/CNPq.

MMA. 2014. Lista das Espécies da Fauna Brasileira Ameaçadas de Extinção. Ministério do Meio Ambiente. Accessed at http://www.icmbio.gov.br/portal/biodiversidade/fauna-brasileira/lista-de-especies.html, 10 February 2015.

Oliveira, J.A. and S.M. Franco. 2005. A coleção de mamíferos do Serviço Nacional da Peste no Museu Nacional, Rio de Janeiro, Brasil. Arquivos do Museu Nacional 63(1): 13–20.

Oliveira, T.S., M.A. Figueiredo, R.S. Nogueira, S.C. Sousa, S.S.G. Souza and R.R. Romero. 2007. Histórico dos impactos antrópicos e aspectos geoambientais da Serra de Baturité, Ceará; pp. 17–72, in: T.S. Oliveira and F.S. Araújo (ed.). Biodiversidade e conservação da biota na serra de Baturité, Ceará. Fortaleza: Edições UFC, Coelce.

Olmos, F., W.A. Silva and C. Albano. 2005. Grey-breasted Conure *Pyrrhura griseipectus*, an overlooked endangered species. Cotinga 24: 77–83.

Paiva, M.P. 1973. Distribuição e abundância de alguns mamíferos selvagens no estado do Ceará. Ciência e Cultura 25(5): 442–450.

Paglia, A.P., G.A. Fonseca, A.B. Rylands, G. Herrmann, L.M. Aguiar, A.G. Chiarello, Y.L.R. Leite, L.P. Costa, S. Siciliano, M.C.M. Kierulff, S.L. Mendes, V.C. Tavares, R.A. Mittermeier and J.L. Patton. 2012. Annotated checklist of Brazilian mammals. 2nd edition. Occasional Papers in Conservation Biology 6: 1–77.

Patton, J.L. and L.P Costa. 2003. Molecular phylogeography and species limits in rainforest Didelphid marsupials of South America; pp. 63–81, in: M. John, C. Dickman, and M. Archer (eds.). Predators with pouches: the biology of carnivorous marsupials. Collingwood: CSIRO Publishing.

Passos P., D.S. Fernandes and D.M. Borges-Nojosa. 2007. New species of *Atractus* (Serpentes: Dipsadinae) from a relictual forest in Northeastern Brazil. Copeia 2007: 788–797. doi: 10.1670/07-115R3.1

Peres, C.A. and H.S. Nascimento. 2006. Impact of game hunting by the Kayapo of south-eastern Amazonia: implications for wildlife conservation in tropical forest indigenous reserves. Biodiversity and Conservation 15(8): 2627–2653. doi: 10.1007/s10531-005-5406-9

Prance, G.T. 1982. Biological diversification in the tropics. New York: Columbia University Press.

Roberto, I.J., L. Brito and M.T.C. Thomé. 2014. A new species of *Rhinella* (Anura: Bufonidae) from Northeastern Brazil. South

American Journal of Herpetology 9(3): 190–199.

Rocha, F.D. 1908. Catálogo da collecção de mamíferos. Boletim do Muzeu Rocha 1: 15–21.

Rocha, F.D. 1945. Mammalia cearense (mamíferos do Ceará que temos denominados até hoje); pp. 420–422, in: R. Girão and A. Martins-Filho (eds.). O Ceará. 2ª Ed. Fortaleza: Editora Fortaleza.

Rocha, F.D. 1948. Subsídio para o estudo da fauna cearense. (Catálogo das espécies animais por mim coligidas e notadas). Revista do Instituto do Ceará 62: 102–138.

Rodrigues, M.T and D.M. Borges. 1997. A new species of *Leposoma* (Squamata: Gymnophthalmidae) from a relictual forest in semiarid Northeastern Brazil. Herpetologica 53(1): 1–6. doi: 10.2307/3893238

Sikes, R. S., W.L. Gannon and Animal Care and Use Committee of the American Society of Mammalogists. 2011. Guidelines of the American Society of Mammalogists for the use of wild mammals in research. Journal of Mammalogy 92(1): 235–253. doi: 10.1644/06-MAMM-F-185R1.1

Sousa, M.A., A. Langguth, A. and E.A. Gimenez. 2004. Mamíferos dos brejos de altitude Paraíba e Pernambuco; pp. 229–254, in: K.C. Porto, J.J.P. Cabral and M. Tabarelli (eds.). Brejos de altitude em Pernambuco e Paraíba, História Natural, Ecologia e Conservação. **Brasília:** Ministério do Meio Ambiente.

Tribe, C.J. 2005. A new species of *Rhipidomys* (Rodentia – Muroidea) from north-eastern Brazil. Arquivos do Museu Nacional 63(1): 131–146.

Vanzolini, P.E., A.M.M. Ramos-Costa and L.J. Vitt. 1980. Répteis das caatingas. Rio de Janeiro: Academia Brasileira de Ciências.

Weksler, M. and C.R. Bonvicino. 2005. Taxonomy of pigmy rice rats genus *Oligoryzomys* Bangs, 1900 (Rodentia, Sigmodontinae) of the Brazilian Cerrado, with the description of two new species. Arquivos do Museu Nacional 63(1): 113–130.

Author's contribution statement: HF-F, NMG-F and AF collected the data and wrote the text; SVM collected the data; RRNA and AR wrote the text and coordinated the research.

Received: December 2014
Accepted: March 2015
Editorial responsibility: Guilherme Siniciato Terra Garbino

APPENDIX 1. List of specimens examined and the municipalities where they were collected, photographed or sighted.

Marmosa murina - Guaramiranga: UFPE 1078. ***Micoureus demerarae*** - Aratuba: UFPB-NG10; Pacoti: MNRJ 28987. ***Monodelphis domestica*** - Baturité: MNRJ 16653, 16648, 1669, UFC0007; Pacoti: MNRJ 27936, 16667. ***Monodelphis americana*** - Pacoti: CMUFC 0142, MZUSP 29458, 29461, 29464; Aratuba: visual record. ***Didelphis albiventris*** - Baturité: UFC004; Aratuba, Pacoti, Mulungu, Caridade, Guaramiranga: visual record; Aratuba: photographic record. ***Didelphis gr. marsupialis*** - Aratuba: UFPB6261; Mulungu, Pacoti: visual record; Mulungu: photographic record. ***Euphractus sexcinctus*** - Guaramiranga, Aratuba: photographic record. ***Dasypus novemcinctus*** - Caridade: UFPB 6595, 6596. ***Tamandua tetradactyla*** - Mulungu: UFPB 6591, 6598, visual record. ***Coendou baturitensis*** - Aratuba: UFPB 6809; Baturité: UFPE 2387; Pacoti: MN 34504; Mulungu: visual and photographic record. ***Galea spixii*** - Aratuba: photographic record. ***Rhipidomys cariri*** - Pacoti: UFC 0083, MN17373, 17441, 17444, 30010; Baturité: UFC013, 015, 016. ***Oligoryzomys cf. nigripes*** - Pacoti: MN-SNP– BT 22. ***Necromys lasiurus*** - Baturité: MN47979. ***Cerradomys langguthi*** - Baturité: MN20701, 20702, 20704, UFC096; Pacoti UFC002. ***Euryoryzomys aff. russatus*** - Baturité: MZUSP-MRT 05, 011, 015, 027, 038. ***Holochilus sciureus*** - Pacoti: MZUSP8704, 8705, 8706, 8707, 8708. ***Mazama gouazoubira*** - Aratuba: UFPB HFF10; UFPB 6590, HFF11, UFPB 6598; Caridade: UFPB 6589. ***Cerdocyon thous*** - Mulungu: photographic record (road-killed specimen, 04°17'34" S, 38°58'39" W) and visual record. ***Speothos venaticus*** - Aratuba: UFPB 6272. ***Leopardus pardalis*** - Mulungu: UFPE 2001. ***Leopardus wiedii*** - Mulungu: UFPE 1996, 2003. ***Leopardus tigrinus*** - Mulungu: UFPE 1942, 2002, 1997, 1998. ***Puma yagouaroundi*** - Aratuba: UFPB 6594, visual record; Mulungu: UFPE1992, 1994; Caridade: UFPE1943. ***Puma concolor*** - Caridade: UFPB 6597. ***Procyon cancrivorus*** - Aratuba: UFPB6656, photographic record. ***Conepatus amazonicus*** - Caridade: visual record. ***Callithrix jacchus*** - Pacoti: MN3930, 3950, 3938, 5528, 3939, 3947, 3954, 5521, 5544, 3932, 3933, 3935, 3937, 3940, 3942, 3944, 3948, 3949, 3952, 3953, 3956, 5517, 5535, 5536, 5546, 5575, 5577, 23771, 23772, 3945, 5545, 3951, 5543, 5572, 5576, 3941, 3946, 5573, 3955, 5551, 3957, 3943, 3933, 3934, 3931; Baturité: MZUSP 8694, 8695, 8693, 8695, 8696; Mulungu: photographic record.